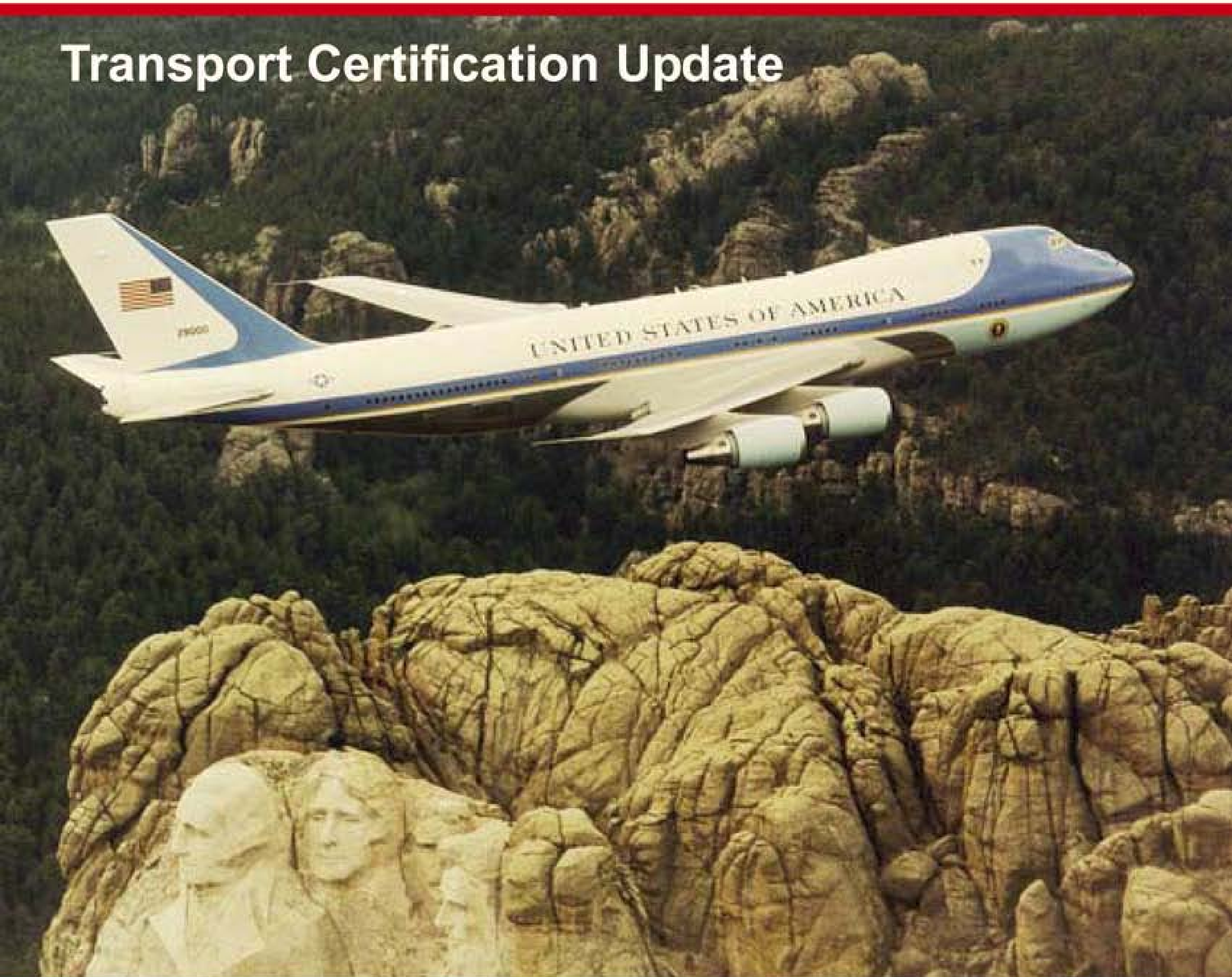
Federal Aviation Administration

Transport Certification Update



Inside:

The FAA's evolving role in security
Integrated Modular Avionics
The Aging Airplane Program in 2011

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Edition 30, Fall 2011

Northwest Mountain Region
Federal Aviation Administration
Department of Transportation

Transport Certification Update

From the Directorate Manager:
Everything is connected

It's been just over 10 years since the terrorist attacks on September 11, 2001.

On January 10, 2002, less than 120 days after September 11, the FAA amended design and air carrier operation regulations to establish standards for intrusion and ballistic penetration resistance. In less than 2 years, 8000 of the newly certified doors were installed on transport category airplanes. These actions were prompt and appropriate; however, they were also reactive and driven by the circumstances.

Today, whenever the air transportation system is discussed, the words "safety" and "security" go hand in hand. Safety and security are connected, as are the dedicated people in the responsible agencies and organizations. We have continued to work with the Transportation Security Administration (TSA) and industry partners to develop systems that extend security protection to other areas of the aircraft such as counterterrorism applications, enhanced bulkhead security, and other design features.

Over the past 10 years, we have evolved significantly in the way we view our role and responsibilities in improving the safety and security of the air transportation system. We have realized the benefit of collaboration and coordination of our efforts with other agencies. We have developed internal processes to achieve full coordination with our colleagues in the Department of Homeland Security, the FBI, and, in the case of the recent action involving chemical oxygen canisters, our international partners. The action involving chemical oxygen canisters mandated their removal from lavatories due to a security vulnerability. What makes these types of actions challenging is the need to keep the information within the community that needs to know about it. Add to that a continuous balancing act between design of safety features and potential security vulnerability, which we achieve through risk management. Despite the enormity of the task, once the needed data are obtained and the subject matter experts in the agencies are engaged, a consistent desirable outcome is pretty much ensured.

In other words, we need to consistently think of the system as a single entity. Not an easy goal, but in this prolific age of the use of personal electronic devices coupled with a desire to be connected all the time through Wi-Fi networks and increased airplane-level integration systems, it is a must-achieve goal. It is one that we examine further in this issue with network security and integrated modular avionics approvals.

It is clear that September 11, 2001, was a point in history that made it abundantly clear how connected we all are and how important our role is. Today, we develop standards, monitor operations, develop actions to ensure fleet safety, and revise the regulatory standards for new technology and new areas of consideration to achieve safety. Staying connected and fully coordinated with all our stakeholders is what's essential to achieve security.

- Ali Bahrami

Features

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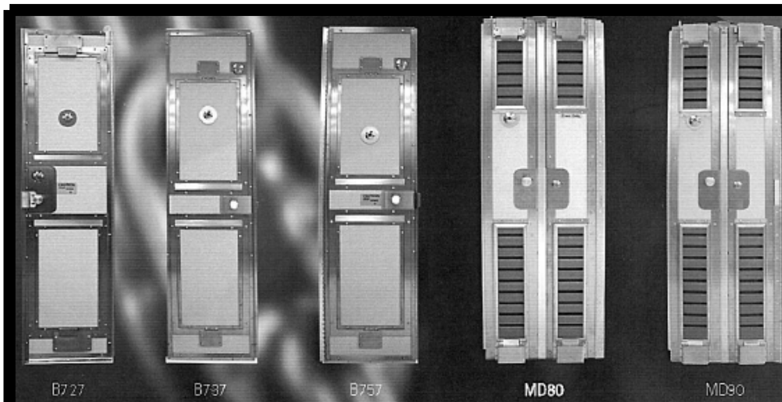
9/11: Ten years later
FAA's evolving role in security

The FAA has always had an aviation safety and security role in response to terrorist acts, such as hijackings and detonation of explosive devices.

Following the terrorist attacks of September 11, 2001, the Transportation Security Administration (TSA), part of the Department of Homeland Security (DHS), took a primary role in security responsibilities. The creation of the TSA, however, did not remove the FAA from the aviation security environment. In fact, the FAA has increased its efforts to improve aircraft design for security during certification. Throughout this time, the FAA's efforts to set standards for aircraft design for security have been evolving, and as such we play a key role in the relationship between security and safety. As designs evolve and become more complex, the need for security features to protect the aircraft will become even more critical. Some of the important related actions are described below.



Reinforced flight deck doors

Reinforced flight deck doors

One of the first global aviation security initiatives in the aftermath of 9/11 was to mandate the installation of reinforced flight deck doors to further restrict unauthorized access to the flight deck. On January 10, 2002, as authorized by the Aviation Transportation and Security Act, the FAA amended Title 14, Code of Federal Regulations (14 CFR) parts 25 and 121. The amendments established performance standards for intrusion and ballistic penetration resistance of flight deck doors.

In less than two years after 9/11, over 8,000 reinforced doors were installed on transport category airplanes worldwide.

Continued on page 4

DHL cargo Airbus Model A300, struck by MANPADS

(continued from page 3)

Counter-MANPADS

Soon after 9/11, two shoulder-fired, heat-seeking missiles (also known as man-portable air-defense systems (MANPADS)) narrowly missed an El Al (Israeli) Boeing Model 757 airplane on a flight from Mombassa, Kenya, to Israel. In another incident, a DHL contract cargo airplane (Airbus Model A300, seen on page 3), operating out of Baghdad, Iraq, during Operation Iraqi Freedom was struck by a shoulder-launched ground-to-air missile, resulting in severe wing damage, fire, and complete loss of hydraulic flight control systems. Despite a successful landing, the airplane was a total loss.

In response to these events, DHS initiated a program to equip civil airliners with self-protection systems. DHS was responsible for determining that the missile defense systems developed through the DHS program performed adequately in defending commercial aircraft from a threat from MANPADS.

As with any certification project, the FAA was responsible for determining that the installation met the applicable airworthiness or safety requirements. In accordance with the Intelligence Reform and Terrorism Prevention Act of 2004, the FAA accepted DHS's certification that the missile defense systems are effective and functional (i.e., perform their intended functions).

DHS worked with several organizations to develop, certify, and operate counter-MANPADS. In 2006, the FAA issued three supplemental type certificates for installation of these systems on 11 cargo airplanes and 3 passenger airplanes.

Aircraft Design for Security Initiative

On October 17, 2008, the FAA amended the regulations to adopt new aircraft security design standards. These standards are based on standards adopted in 1997 by the International Civil Aviation Organization (ICAO). They provide greater protection of the cabin, flight deck, and cargo compartments from detonation of explosive or incendiary devices, penetration by projectiles, or intrusion by unauthorized persons. For example, the rule now requires that the flight deck bulkhead be reinforced in the same way as the flight deck doors. The rule also requires operators to establish a "least risk bomb location" on existing transport category

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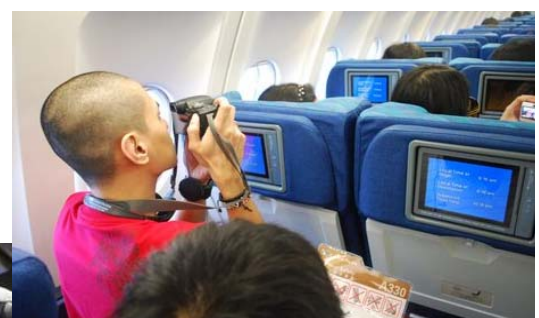

Evolving and interfacing technology can present aviation security risks.

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airplanes, that is, a location where a suspected device could be placed until the crew can land the airplane.

Network security

Security includes more than protection from ballistics and missiles. It also includes protecting other areas of the airplane—such as the avionic systems—from being compromised.

The use of information technology (IT) on airplanes has changed significantly over the years, and the evolutionary progress of IT is rapidly accelerating. Airplane systems are evolving from federated systems (independent black boxes) to complex integrated and connected systems. The system architecture of newer transport airplanes allows new kinds of passenger connectivity to previously isolated data networks connected to systems that perform functions required for the safe operation of the airplane, such as integrated modular avionics (IMA) systems. In addition, these airplanes have an architecture and network configuration that allow increased connectivity by external airplane sources such as airline operations and maintenance systems. This external connectivity to the aircraft data networks permits access to functions required for the safe operation and maintenance of the airplane.

This new architecture and network configuration, however, may allow the exploitation of network security vulnerabilities if suitable protections are not in place to prevent the intentional or unintentional destruction, disruption, or degradation of data, systems, and networks critical to aviation safety.

The existing part 25 regulations do not address these potential network security vulnerabilities that can be exploited by unauthorized access to aviation data networks. The FAA has been issuing special conditions to ensure that security, integrity, and availability of the aircraft systems and data networks are not compromised by certain wired or wireless electronic connections between airplane data buses and networks.

Based on current industry trends, the FAA and industry are likely to face more challenging cyber-security issues. Airplane manufacturers are moving to more "open" architectures for highly integrated and complex functions. Airplane manufacturers are also handing off detailed design, development, and testing of components and software for highly integrated avionics systems to suppliers all over the world. It is important that we work with industry on these issues to foster secure designs.

The role of airworthiness directives (ADs) in security

The advent of "security measure in design" introduces the idea that some design features or defects may be considered security vulnerabilities. This has been a particular concern with flight deck doors. As mentioned earlier, more than 8,000 doors were modified in 18 months. With new rules and compressed certification schedules involved, it is not unexpected that additional safety-related design changes need to be made.

When mandatory action is warranted, the awareness of the security vulnerability must be limited to those who have a need to know. The Transport Airplane Directorate (TAD) has developed a process for issuing ADs that contain sensitive security information (SSI). With each individual sensitive security AD (SSAD), the TAD works closely with the TSA and the FAA's Flight Standards Service to determine how best to correct the security vulnerability and communicate with the affected parties regarding the AD's requirements.

Continued on page 6

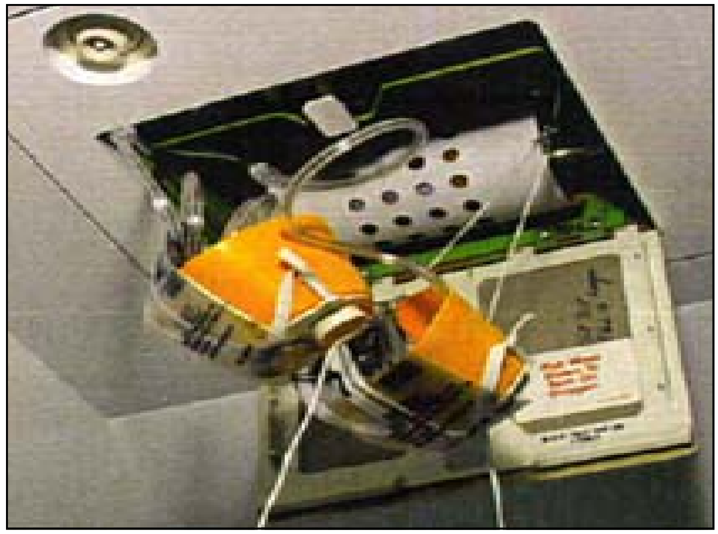
What is SSI?

Sensitive security information (SSI) is a subset of sensitive unclassified information. SSI characterization is specific to the Department of Transportation. It is covered in 49 CFR part 15 and explained in FAA Order 1600.75. 49 CFR Part 15, "Protection of Sensitive Security Information," governs the maintenance, safeguarding, and disclosure of information that DOT determines to be SSI. SSI includes information that, if disclosed, would be detrimental to transportation safety.

(continued from page 5)

The FAA has issued eight SSADs to date. One of the first SSADs issued was on a reinforced flight deck door installed on certain transport category airplanes. The electronic locking system on this flight deck door was vulnerable to electromagnetic interference (EMI). This unsafe condition was addressed by the issuance of an SSAD.

A recent, highly publicized SSAD addressed chemical oxygen generators that are widely used in airplane lavatories. The FAA, in conjunction with the TSA and the Federal Bureau of Investigation (FBI), identified a potential hazard with the chemical oxygen generators. On February 10, 2011, the FAA issued an SSAD to correct this safety concern.



Oxygen mask

SSI in type design

It is worth noting that the regulation covering SSI also applies to industry, including operators and design approval holders. For more information, see Order 1600.75, "Protecting Sensitive Unclassified Information" (http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgOrders.nsf/0/d6e9b23bc39dc998862573ca00607333/$FILE/ND1600-75.pdf).

The future of aviation safety

Based on our experience over the last decade, the FAA anticipates that security considerations in airplane design will continue to change over time. The TAD will continue to be proactive in addressing these issues, whether it involves flight deck protection, network security, or other areas of airplane designs. ✈

787 flight deck

Integrated Modular Avionics:

New architectures/new challenges

The first generation of "glass cockpit" commercial aircraft – those that use electronic displays – entered service in the early 1980s with aircraft such as the Boeing 757 and 767 and the Airbus A310. These aircraft were also the first modern commercial airliners that began to fully utilize digital computing systems to implement system functions instead of the earlier analog electronic or mechanical systems. Systems with this earlier architecture are referred to as "federated" systems. This means that the equipment for each aircraft system or function comprised line-replaceable units that each performed a specific function, and were connected point-to-point using dedicated interfaces or data buses. There was very little sharing of resources, such as computing, software, and supporting interfaces (e.g., Input/Output (I/O), electrical power, and cooling systems). Each aircraft function was supported by a stand-alone collection of sensors, actuators, and software processing units. Avionics cabinets contained identifiable modules with specific functions such as flight management, autopilot, and navigation. The disadvantages of each module performing separate functions were significant: high cost, weight, power consumption, power dissipation, and limited real estate.

Beginning early in the 1990s, due to advances in computer technology, aircraft manufacturers and aircraft system suppliers began to take advantage of increased computer processing capability and started combining multiple federated systems into systems that shared a platform and resources, commonly referred to as Integrated Modular Avionics (IMA) systems. Because the development of IMAs was an evolutionary process rather than a revolutionary one, there is no definitive answer to the question, "What was the first IMA system to be utilized on a commercial jet aircraft?" A good example of an early IMA system is the Aircraft Information Management System (AIMS) installed on the Boeing 777. More recent examples of IMA systems include the following:

- The Honeywell Primus Epic® system installed on a number of business aircraft, including the Embraer E-170/E-190 series; the Gulfstream G450, G550, and G650; the Dassault Falcon 2000 "eASY"; and the Agusta AB139 helicopter.
- The Rockwell Collins Pro Line Fusion® system installed on a number of business aircraft, including the Embraer 550 business jet, the Gulfstream G280, and the Bombardier C-Series aircraft.
- The Boeing 787 Common Computing System, installed on a transport aircraft, developed by Boeing, GE, Rockwell Collins and numerous other suppliers.
- The Airbus A380 Avionics Suite, developed by Thales, installed on a transport aircraft.

What is an IMA System?

An IMA system is airborne computer system architecture that hosts one or more aircraft functions. This architecture consists of a real-time operating system (RTOS), a board support package, a platform, modules, and components that are designed and managed in a way to provide computational, communication, and interface capabilities for hosting different applications. An easy-to-understand example is a generic laptop personal computer that may be loaded with various software applications, such that the computer user can now perform word processing, do spread sheets, develop presentation slides, access the internet, and watch DVDs and streaming video. This is what an IMA system is: a generic platform that can host many different functions. An IMA system routinely supports aircraft functions traditionally considered to be thought of as "avionics," such as flight deck displays, navigation, communication, autopilot, and flight management. Because of their increased capability, IMA systems may also support other aircraft

Continued on page 8

(continued from page 7)

functions such as electrical power control and distribution and fly-by-wire flight controls. What defines an IMA system, therefore, is not the aircraft functionality it provides, but the attributes of the system architecture:

- Multiple, possibly unrelated, aircraft functions that share computing resources, I/O functionality, and other generic supporting system infrastructure.
- Generic modules, such as computing modules, interface modules, and power supplies, which can host software that implements varying aircraft functions without being designed specifically for that function.
- Different aircraft functions separated from each other, so that failures in one area cannot adversely affect a different partition.
- I/O resources shared between functions.
- System architecture and supporting software developed in such a way that hardware and resources may be updated without affecting the hosted functions.
- A dedicated data network that allows data to be exchanged between system components.
- System-level common failure modes that have the ability to affect multiple aircraft functions hosted on that system (electrical power failure or loss of cooling air for example).

Given these very significant benefits, we expect that IMA system architectures will be more and more common on future aircraft.

Architectural considerations and risks

Although there are numerous reasons for the commercial aerospace industry to move toward highly integrated, modular avionics systems, that move does not come without new considerations and additional risks that require active management to ensure safe operation of the airplane.

Higher Level of integration than federated systems

The integration of IMA systems is an extremely complex process that requires a significant amount of work to demonstrate that applicable availability, integrity, and safety requirements are satisfied. The parts of an IMA system may be developed by multiple sources or a single company supplying work for an aircraft manufacturer, further complicating the already considerable challenge of properly integrating an IMA system.

There are a number of levels of integration that are required for IMA systems that did not exist with federated systems. Software applications need to be integrated into the hosting hardware. Hardware modules need to be integrated into the supporting system infrastructure, such as the cabinets, electrical power, cooling, and the data network. All the components, both hardware and software, need to

Continued on page 9

Why use IMA systems?

Aircraft manufacturers and suppliers of airborne systems have moved toward highly integrated systems for many reasons:

- Fewer installation requirements compared to federated systems, such as a reduced module count, less installation “real estate,” less power consumption, less forced air cooling, and less dedicated airplane wiring.
- Ability to host multiple, varied aircraft functions in a single architecture without being designed specifically for that purpose.
- Ability to accommodate future changes and updates to aircraft functions—including additional functions yet to be defined—without updating the IMA architecture and without affecting other functions hosted on the IMA.
- The ability to accommodate needed updates to the hardware when certain parts become obsolete without having to redesign the entire system hardware.
- Ability to upgrade system software without having to change hardware.
- Fault-tolerant design.
- Use of well-defined non-proprietary interfaces and protocols.
- Fewer types of modules needed for airlines to stock as spares, due to the generic nature of the modules, which can then be loaded with the most current software on the aircraft.
- Ease of on-aircraft maintenance.

be integrated and tested together to ensure that specific aircraft functionality works as intended. Finally, the entire IMA system needs to be integrated into the aircraft. A simple analogy for the IMA system is "a system of systems." Each individual system is, by itself, complete. But a large amount of effort is involved in integrating all the systems together in order to demonstrate that all the systems operate together in a robust manner when the IMA is installed on an aircraft.

Common failure modes that may affect multiple functions

Because IMA architectures include shared common resources, the failure conditions of those resources, such as computing modules, I/O, or data busses, now can affect multiple aircraft functions simultaneously. System safety assessments and failure analyses must account for this effect. Analyses of multiple failure modes become a much greater challenge, not only from loss of common resources but also from the loss of the output data from the affected functions. Failure conditions that may be a major safety effect by themselves, for instance, could possibly be elevated to a hazardous safety effect when the total effects on the multiple aircraft functions are considered.

Since IMA systems host aircraft functions using shared resources such as electrical power, computer processing, and memory, there is a potential for a single event upset to adversely affect multiple different aircraft functions, applications, and partitions. Designing for the appropriate level of redundancy into the IMA platform design, aircraft resources, and fault management should address the potential for single event upsets and provide for appropriate recovery. Additionally, cascading failures — that is, failures in one system that flow to downstream users and cause upsets or failures in those systems as well — should be part of this analysis and design.

Validation and verification: More challenges for complex IMA systems

Validation and verification (V&V) are standard tasks used in approving airborne systems. The purpose of these tasks is to show that a system performs as intended and contains no "surprises" that may not be apparent under normal operating conditions. Validation is the activity required to show that the requirements allocated to an aircraft system are the correct requirements, and are completely addressed. Validation should also ensure that the functions hosted by the system work correctly under normal conditions and operate in a robust manner. The verification process, on the other hand, ensures that the system has been correctly implemented and performs its intended functionality as defined by the requirements levied against that system.

Therefore, to summarize, the validation process ensures that the system satisfies its requirements. The verification process ensures that the system performs to its specifications. Both of these activities are required to ensure the system performs its intended function—safely—when it is installed on the aircraft.

Because of the magnitude of the functionality supported by IMA systems and the possibility of unintended operation and unanticipated interactions between

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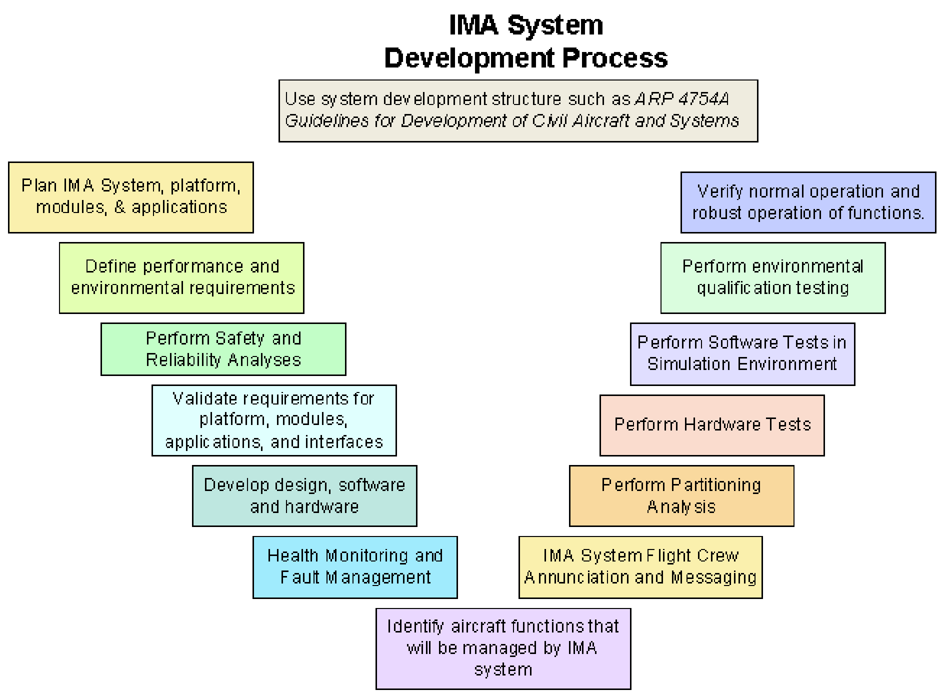

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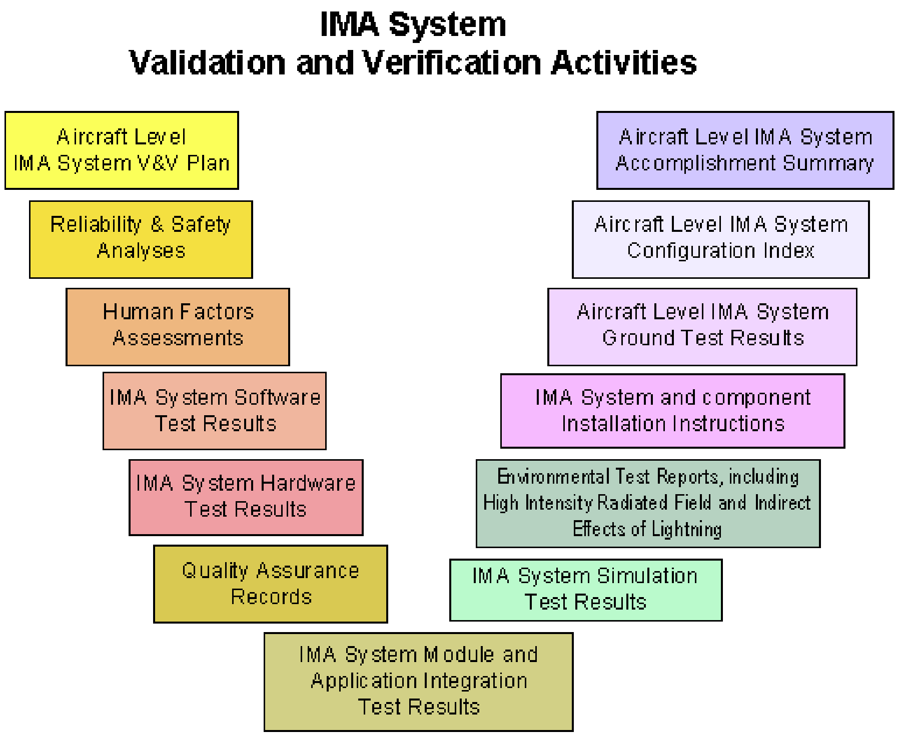

the functions, the task of V&V is more challenging than it has been in the past. When multiple individuals from the same or multiple companies are involved in a single IMA project, the V&V process becomes complex. V&V now needs to be performed by the different players: the RTOS provider, module and application suppliers, and the aircraft manufacturer. Compliance with the applicable requirements using analyses, laboratory testing, simulation, and ground and flight test results should be fully documented. This is especially critical with regards to the evaluation of possible repercussions of specific anomalies, such as a loss of multiple aircraft functions.

None of the V&V activity required for an IMA system is conceptually any different from what was required for federated systems. However, what has changed is the sheer magnitude of the task as well as the specific nature of some of the V&V tasks that must account for the highly integrated nature of IMA systems.

Guidance and policy

Existing regulations, policy, and guidance material that apply to federated systems also apply to IMA systems. There is guidance available specifically for IMA systems, however. The FAA recently published AC 20-170, *Integrated Modular Avionics Development, Verification, Integration, and Approval Using RTCA/DO-297 and Technical Standard Order-C153.* The guidance in this AC provides a complete, yet flexible approach to documenting an acceptable means of compliance for the development, verification, and approval of IMA systems, using RTCA DO-297 as the basis. The DO-297 specification describes the roles that application developers, platform providers, and system integrators must play for orderly and safe integration of modular avionics.

In addition to this AC, the FAA plans to issue an accompanying order that will provide FAA engineers who approve IMAs the FAA processes that are used to support an applicant's use of AC 20-170.

Also in development is an AC that will recognize SAE Aerospace Recommended Practice (ARP) 4754A, *Guidelines for Development of Civil Aircraft and Systems,* as an acceptable means of compliance for complex airborne systems. This industry standard will discuss the development of aircraft systems, taking into account the overall aircraft operating environment and functions. It will also include validation of requirements and verification of the design, and demonstrate how applicants can show compliance to the regulations. When that guidance material becomes available, it will greatly assist applicants for aircraft certification and IMA suppliers in the tasks of planning, developing, validating, verifying, and installing a complex IMA system.

Misunderstandings about TSOAs

Some developers of IMA systems, in addition to supporting their customers with the necessary documentation, analyses, and test results required for aircraft certification, apply for a technical standard order authorization (TSOA) for many of the aircraft functions that are hosted by the IMA. By itself, this causes no

Continued on page 11

(continued from page 10)

problems since there are numerous reasons why suppliers of avionics systems apply for TSOAs.

What is TSO Authorization?

TSO authorization indicates that an article has been shown to meet the requirements defined in the TSO minimum performance specification. TSOA does not provide installation approval on an aircraft. The TSO-authorized article can be installed in any aircraft by showing that the installation requirements for that aircraft have been met, including all applicable regulations, guidance material, issue papers, etc.

A potential problem may arise, however, when an aircraft manufacturer attempts to apply for certification credit toward installation approval for the IMA system by requesting to use credit from TSOAs that do not address the necessary regulations. For example, it is currently not possible to obtain a TSO authorization for a complete IMA system, because no such TSO exists. There is a TSO (FAA TSO-C153) that covers authorization for the generic hardware modules and racks that can later be loaded with software that implements aircraft functionality. Additionally, there are numerous other TSOs that are specific to the actual functions that are hosted on an IMA. But there is no single TSO or combination of TSOs that covers all the other activities required to show that an IMA system is compliant with the regulations for installation.

To gain approval to install an IMA system on an aircraft, a certification applicant must demonstrate that the IMA system is compliant with all the applicable regulations. TSO authorizations may be used for this purpose, but only for certain aspects of the IMA system. The guidance material contained in AC 20-170 explains how this may be done.

The following list shows the most appropriate use of TSOAs for certification credit for the aircraft installation:

1. Compliance to RTCA/DO-178B for airborne software.
2. Compliance to RTCA/DO-254 for airborne electronic hardware.
3. Compliance to RTCA/DO-160G for environmental qualification testing.

All other certification aspects required for approval of an IMA system installation should be accomplished during the aircraft certification program.

Expanding use of IMAs

Complex IMA systems in recent years have gained widespread acceptance in commercial aviation. IMA systems are already installed on a vast majority of newly developed part 25 aircraft, such as the Boeing 787 and Airbus A380, as well as a significant percentage of previously certified aircraft that are being updated. In addition, complex IMA systems are being incorporated on some part 23 small airplanes as well as part 29 rotorcraft. IMAs are becoming the standard for aircraft systems. Both the civil aviation industry and the FAA will benefit when all issues associated with these complex aircraft systems are identified and addressed in a timely manner. ✈

Systems approach to aging airplane safety
A milestone year for aging airplane rulemaking

Now that the final piece of planned rulemaking on aging airplanes, Widespread Fatigue Damage, is effective, and the implementation of the Enhanced Airworthiness Program for Airplane Systems/Fuel Tank Safety (EAPAS/FTS) and Aging Airplane Safety Rule (AASR) have signified completion of all other associated activities, it's a good time to recap the rulemaking activity associated with the Aging Airplane Program (AAP).

Background of AAP

Accidents such as those involving de Havilland Comet 1 due to fatigue cracking, and the Dan-Air Model 707 due to the loss of the horizontal stabilizer, highlighted the need for changes in design and inspection philosophy from the existing "safe-life" or "fail-safe" philosophies. For example, the introduction of damage-tolerance-based inspections and a repair program provided enhanced safety over that provided by simply replacing components at a certain service milestone. The loss of fuselage skin and structure from Aloha Airlines flight 243 added a sense of urgency for the Aging Airplane Program. Investigation of AAH243 revealed a need for a more holistic approach to ensuring the safety of an airplane as it ages through exposure to flight cycles/ stresses and corrosive environmental conditions.

Other accidents such as TWA 800 in 1996, and Swissair SR111 in 1998, introduced other areas of focus, such as the effects of service life on the robustness of electrical wiring and system components, and the effects of adding components to an airframe or system. Hence, the EAPAS/FTS rulemaking was brought under the AAP umbrella after the Swissair accident, which highlighted a weakness in maintaining wiring system safety.

The FAA's Lessons Learned website lists the ADs and other rulemaking that resulted from what was learned from AAH243 (and the other accidents discussed above).

For a related article on widespread fatigue damage, including a discussion of AAH243, see Issue 29 of the Transport Certification *Update* newsletter.

A New Regulatory Approach

Based on earlier lessons learned, 14 CFR part 26 of the Federal Aviation Regulations (FARs) was developed to support the Aging Airplane Program. Within the framework of this new FAR part, rules have been issued for design approval holders (DAHs). The three such rules that have been issued as a result of the Aging Airplane Program all include requirements for certain existing airplanes as well as future airplanes.

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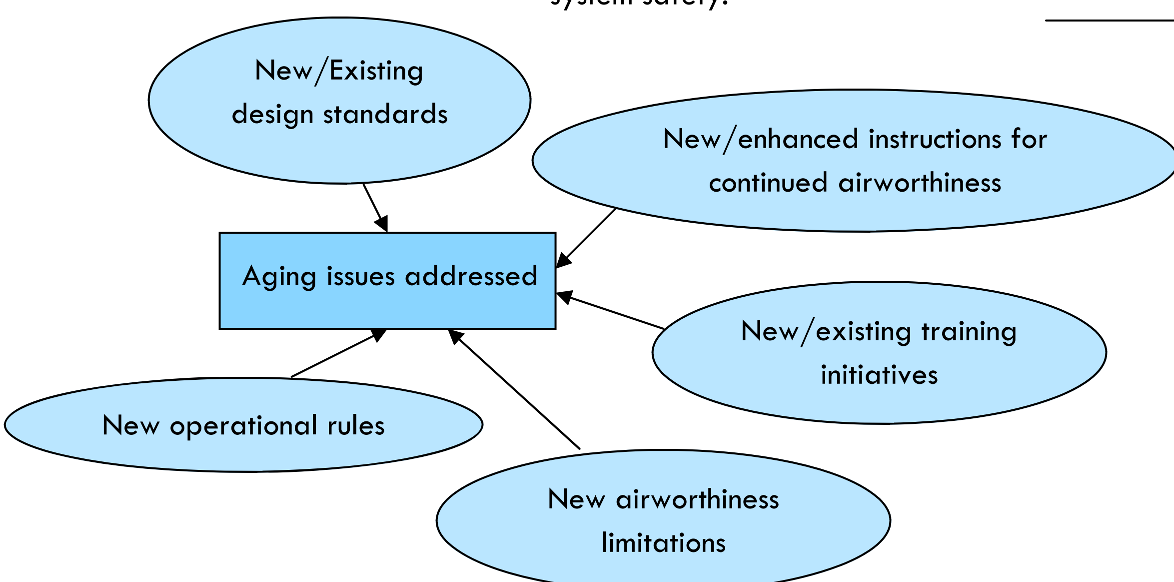

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Holistic Approach to Safety

The AAP affected many different parts of the FAA regulations. The AAP also affected the post-certification or modification life of an airplane. Part 26 requires that design approval holders (DAHs) evaluate the life of the airframe and certain systems and develop related airworthiness limitations to support operators during and after the implementation of various AAP components.

The AAP also reflected a change of direction to a more proactive approach. The AAP involved analyzing data from reporting databases, identifying precursors to accidents, and developing appropriate rulemaking to prevent accidents before any incidents occur.

In 2005, the FAA published the policy statement "Safety – A Shared Responsibility – New Direction for Addressing Airworthiness Issues for Transport Airplanes." This policy is based on the realization that certain safety objectives can be fully achieved only if the DAHs provide operators with necessary information in a timely manner for them to maintain continued airworthiness.

This new regulatory approach therefore includes complementary requirements for DAHs and operators, when appropriate. For example, in some situations, DAHs would be required to develop data for operators within a specified time so that operators can then use the data to comply with operational requirements.

The result was a new type of rulemaking. Unlike previous certification rules that affected only applicants, part 26 also applies to existing DAHs. The decision to develop this new FAR part was made in collaboration with airworthiness authorities of other countries to facilitate harmonization on these key safety initiatives.

The policy statements, and the resulting rulemaking for parts 25, 26, 121, and 129, formed the basis and framework for EAPAS/FTS, AASR, and WFD.

EAPAS/FTS

EAPAS/FTS (effective December 10, 2007) was the first rule to use the DAH (part 26) approach. Under this initial rulemaking package, the FAA formed the framework for part 26. EAPAS/FTS required DAHs to take a new look at their electrical interconnection systems from a new perspective by considering the systems as a whole, reviewing design changes, providing necessary Electronic Wiring

Continued on page 14

These AAP regulations can be found on RGL:

- Part 26, Continued Airworthiness and Safety Improvements for Transport Category Airplanes
- RAP (Repair Assessment Program for Pressurized Fuselages rule)
- Interim AASR (Aging Airplane Safety Rule) – primarily a records review under the purview of Flight Standards Service, published on December 6, 2002
- FTS (Fuel Tank Safety) rule, titled "Reduction of Fuel Tank Flammability in Transport Category Airplanes," published July 21, 2008, corrected on July 6, 2009
- EAPAS rule (published November 8, 2007, and corrected on December 5, 2007
- Final AASR – both AFS and AIR, published December 12, 2007 (as corrected)
- WFD
- Hundreds of ADs on related systems and structures

Most operators have already implemented the following voluntary AAP actions or programs:

- Corrosion prevention and control program (CPCP)
- Voluntary center fuel tank inspection survey by operators to look for safety issues in those tanks
- Voluntary incorporation of improved or new maintenance actions as part of Wiring Safety or CPCP
- Outreach programs such as workshops, training, and presentations at conferences, were also developed for industry and authority audiences on Fuel Tank Safety, Wiring Safety, and Structural Integrity

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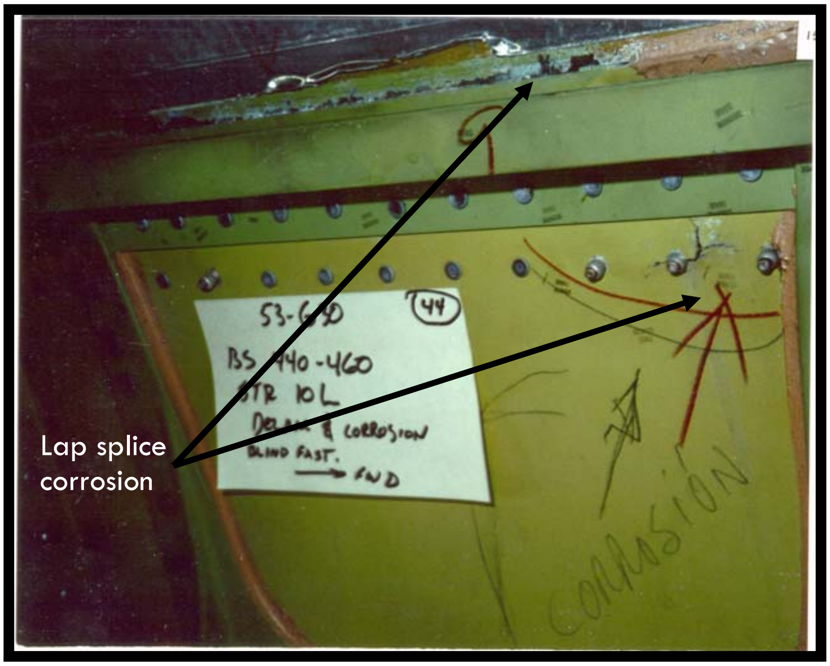

Example of lap splice corrosion
from China Air accident

Interconnect System (EWIS) Instructions for Continued Airworthiness (ICA), having them approved by the FAA, and making them available to operators. EAPAS/FTS required operators to incorporate the EWIS ICA into their maintenance programs by March 11, 2011. Due to all the efforts by many parties (including technical assistance by other airworthiness authorities), all required data and information were made available to and used by operators on time.

In addition, many new part 25 rules were created to apply these same concepts to future designs. Over a dozen advisory circulars (ACs) were issued to provide further information on how to comply with these rules, such as guidance on developing and organizing required documents (for example, ICAs, standard wiring practices manuals, and compliance plans). In conjunction with these rulemaking and AC actions in certification, new part 121 and 129 rules require operators to use these new EWIS ICAs in their maintenance programs. The part 26 and 121/129 rules were implemented in March 2011. The focus has now shifted to applying part 25 and 26 rules to future designs and ensuring maintenance program changes are acceptable.

AASR

The Aging Airplane Safety Rule (AASR), the second DAH rule to be issued, was made effective in 2008, soon after EAPAS was issued. AASR requires all existing repairs and alterations of certain airplanes to be reviewed for damage tolerance; it also requires, where necessary, development of new inspections and intervals for the repairs and alterations. Like EAPAS, certain ongoing requirements of AASR apply to future repairs and alterations. AASR also includes requirements for certain operators to incorporate any new inspections and intervals into their maintenance programs by a certain date. Thanks to the efforts of all affected parties, all required data and essential information were available to and used by airlines on time. For more information on AASR, see Issue 25 of the Transport Certification Update newsletter.

WFD

Like EAPAS/FTS and AASR, WFD requires the DAHs for certain airplane models to develop specific data for the operators to use. WFD requires DAHs to

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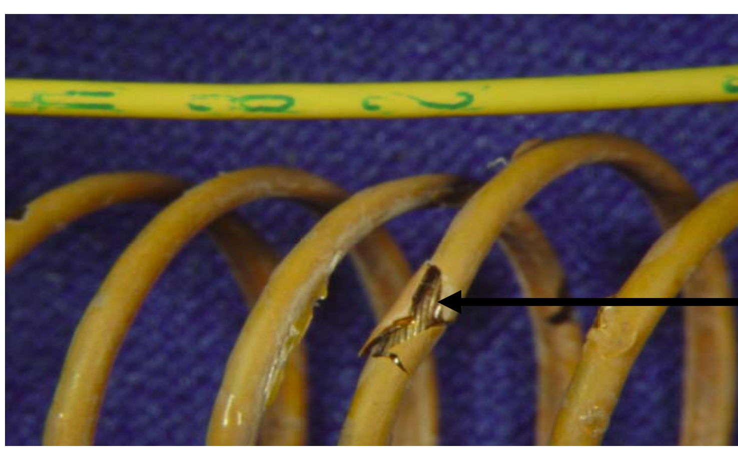

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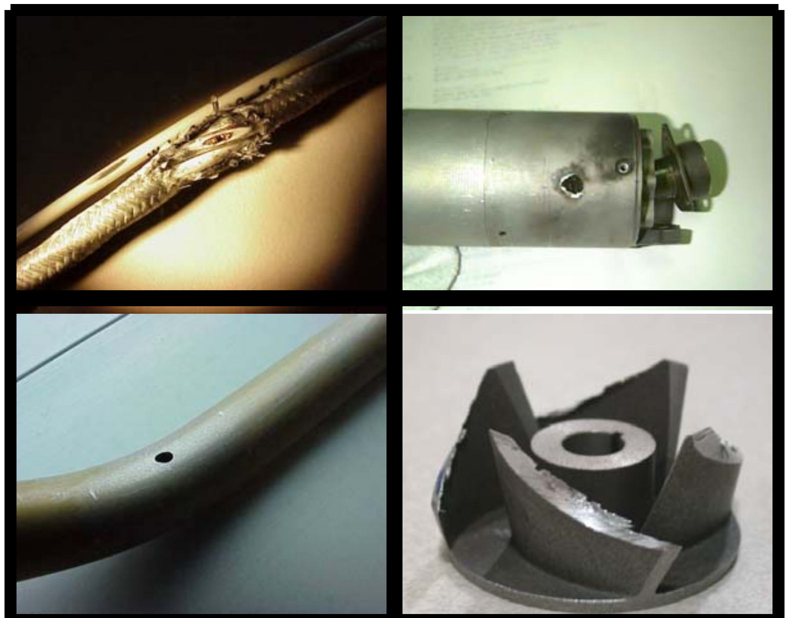
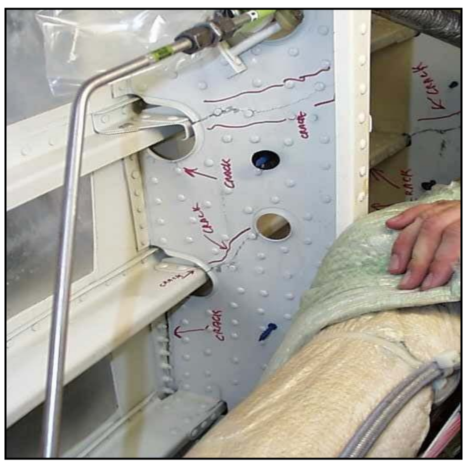
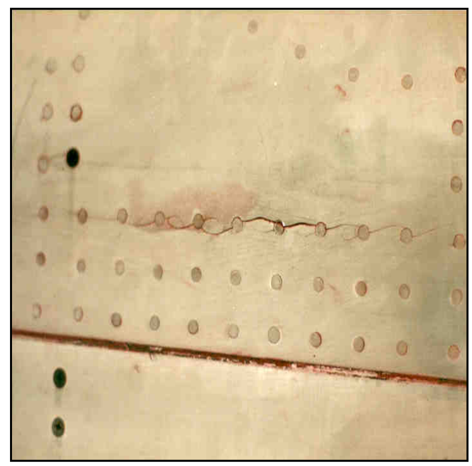
develop and make available a Limit of Validity (LOV) of engineering data to support maintenance programs that are intended to prevent WFD from occurring on airplanes before the LOV is reached. Unlike those rules, however, the timelines for these actions are much longer. Compliance times are based on factors related to risk and age of the fleet; the longest compliance time is 6 years for certain maintenance actions on relatively young airplanes. DAHs are currently developing LOVs that will be implemented by the operators on all affected fleets between 18 and 60 months after the effective date of the WFD (January 14, 2011). For an in-depth article on the WFD rule, see Issue 29 of the Transport Certification *Update* newsletter. ✈



Typical ignition sources found — examples of issues found related to FTS



Frame cracking multiple element damage



Lap splice multiple site damage

Available AAP Training

Training was developed to help industry and authorities learn how to implement the requirements of EAPAS, AASR, and WFD. For those interested in this training, Video Training Distribution Services offers videos on each rule along with a participant guide. This training is oriented toward FAA personnel and is also available to other aviation authorities; an industry-oriented version of this interactive video teletraining (IVT) is available to the public. The material is usually about 12 hours for each rule.

The University of Washington in Seattle, Washington, offers a course on WFD as part of its Aeronautical/Astronautical Engineering degree program. A private educator also offers a week-long course, details of which can be found at http://fdtcourse.com.

Training oriented to an aviation authority audience has been offered internally at every FAA Aircraft Certification Office, via IVT, and via an internal electronic learning system. (For FAA personnel, eLMS online classes include courses 24912 and 27100061 on AASR, 24910 and 27100046 on EAPAS, and 24911 on WFD.) In-person training has been conducted for every DAH affected at the time of the new rules.

CSTAs
Chief Scientific and Technical Advisors

Profile of a CSTA: Robert G. Eastin, CSTA for Fatigue and Damage Tolerance

The FAA's CSTAs are a select group of specialized technical experts at the forefront of the agency's research and development efforts. CSTAs help design and develop aircraft, and apply regulatory policies and practices for certification of technology. They represent the best and brightest, and work in all fields and regions. For more information, see the CSTA website. In this edition we introduce you to another of these 15 experts: Bob Eastin.

FAA's CSTA for Fatigue and Damage Tolerance, Bob Eastin, has over 40 years' experience in structural analysis and design with specialization in the areas of fatigue and damage tolerance. The majority of his experience was with large aerospace companies where he was involved in aircraft engineering development programs that included the DC-10, B-1A, Space Shuttle Orbiter, KC-10, and C-17.

Since June 1997, Mr. Eastin has been the FAA's Chief Scientific and Technical Advisor for Fatigue and Damage Tolerance. In this position he advises on structural fatigue and damage tolerance issues involving analysis, testing, operation, and research and development on transport airplanes, general aviation airplanes, rotorcraft, and engines. He has also served as an advisory member on several Aviation Rulemaking Advisory Committee (ARAC) Working Groups tasked with recommending changes to civil aviation rules and advisory material.

Mr. Eastin has authored many papers, delivered numerous technical presentations, and conducted several workshops on the fatigue and damage tolerance of aircraft structures.

Mr. Eastin is currently the Chairman of the Government Steering Group for the Metallic Materials Properties Development and Standardization (MMPDS) effort (formerly MIL-HDBK-5).

Mr. Eastin earned a bachelor of science degree in Aerospace Engineering from Georgia Institute of Technology, and a master of science degree in Engineering Mechanics from Old Dominion University. ✈

Transport Airplane Directorate (TAD) Regulatory Radar

The following have been published in the *Federal Register* since the last issue of the *Transport Certification Update*. For full text of rulemaking and other actions see: regulations.gov. For full text of policies and advisory circulars, see http://rgl.faa.gov.

Current Rulemaking

Final Rules (FRs)

SFAR No. 111 -- Lavatory Oxygen Systems, § 25.1801; Docket No. FAA-2011-0186; FR publication 3/8/11, effective 3/8/11. Amendment 25-133.

This interim rule temporarily authorizes variances from existing standards related to the provisioning of supplemental oxygen inside lavatories. This action is necessitated by other mandatory actions that temporarily render such oxygen systems inoperative. The interim rule remains in effect until further notice.

Electrical and Electronic System Lightning Protection, § 25.1316; Docket No. FAA-2010-0224; FR publication 6/8/11, effective 8/8/11. Amendment 25-134.

This final rule amends the lightning protection airworthiness standards by establishing new lightning protection regulations for electrical and electronic systems installed on aircraft certificated under parts 23, 27, and 29, and revises lightning protection regulations for electrical and electronic systems installed on airplanes certificated under part 25. This rule establishes two levels of lightning protection for aircraft systems based on consequences of system function failure: catastrophic consequences that would prevent continued safe flight and landing; and hazardous or major consequences that would reduce the capability of the aircraft or the ability of the flight crew to respond to an adverse operating condition. This rule also establishes lightning protection for aircraft systems according to the aircraft's potential for lightning exposure. The airworthiness standards establish consistent lightning protection requirements for aircraft electrical and electronic systems.

Activation of Ice Protection, § 121.321; Docket No. FAA-2009-0675; FR publication 8/22/11, effective 10/21/11. Amendment 121-356.

This action revises the operating rules for flight in icing conditions. For certain airplanes certificated for flight in icing, the new standards require either installation of ice detection equipment or changes to the airplane flight manual to ensure timely activation of the airframe ice protection system. This action is the result of information gathered from icing accidents and incidents. It is intended to increase the level of safety when airplanes fly in icing conditions.

Notices of Proposed Rulemaking (NPRMs)

No new NPRMs have been published since the last Regulatory Radar update in March 2011.

Policy and Advisory Circulars (ACs)

Final Policies Issued

Application of Amendment 25-102; Fuel Tank Prevention and Flammable Vapor Minimization, ANM-02-113-011. Issued 3/9/2011.

This policy clarifies and defines the intended scope of Amendment 25-102 as applied to amended and supplemental type certificate projects. Amendment 25-102 to section 25.981 and part 25, Appendix H, requires design approval holders of certain turbine-powered transport category airplanes, and of any subsequent modifications to these airplanes, to substantiate that the design of the fuel tank system precludes the existence of ignition sources within the airplane fuel tanks. It also requires developing and implementing maintenance and inspection instructions to ensure the safety of the fuel tank system. For new type designs, this rule also requires demonstrating that ignition sources cannot be present in fuel tanks when failure conditions are considered, identifying any safety-critical maintenance actions, and incorporating a means either to minimize development of flammable vapors in fuel tanks or to prevent catastrophic damage if ignition does occur. These actions are based on accident

Continued on page 18

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investigations and adverse service experience, which have shown that unforeseen failure modes and lack of specific maintenance procedures on certain airplane fuel tank systems may result in degradation of design safety features intended to preclude ignition of vapors within the fuel tank.

Draft Policies Released for Public Comment

Statement of Policy on Approving the Installation of PMA Parts as Replacements for Parts Controlled by CDCCLs. Comment period closed 3/11/2011.

This proposed policy would provide guidance on approving the replacement of parts that are controlled by critical design control configuration limitations (CDCCLs) with parts that are produced under a parts manufacturer approval (PMA). Specifically, the proposed policy would address whether PMA components are eligible for installation approval, for cases where a PMA is granted on a basis of identicality with or without evidence of a licensing agreement, or on a basis of test and computation. The proposed policy would also clarify whether approval for installation of a PMA component should be granted as an alternative method of compliance (AMOC) or component maintenance manual (CMM) deviation.

Final ACs Issued

AC 25-7B, Flight Test Guide for Certification of Transport Category Airplanes. Issued 3/29/2011.

This AC provides guidance for the flight test evaluation of transport category airplanes. This AC includes flight test methods and procedures to show compliance with the regulations contained in subpart B of Title 14, Code of Federal Regulations (14 CFR) part 25, which address airplane performance and handling characteristics. Part 25 has been amended significantly since the last revision of this AC and, likewise, guidance and policy have changed in many areas as experience has been gained. During this time period, technology has advanced as well, resulting in a need for new or modified test techniques. This revision, 25-7B, adds acceptable means of compliance for the regulatory changes associated with Amendments 25-108, 25-109, and 25-115, and a revised means of compliance for expansion of takeoff and landing data for higher airport elevations. Means of compliance with flight in icing conditions was removed as this material is now contained in AC 25-25.

AC 121.321-1, Compliance with Requirements of § 121.321, Operations in Icing. Issued 8/4/2011.

This AC describes an acceptable means for showing compliance with the requirements of 14 CFR 121.321, Operations in Icing. This AC provides guidance for a) using visible moisture and temperature as a means for the flight crew to know when to activate the airframe ice protection system (IPS); b) developing acceptable procedures for activating and deactivating the IPS; and c) installing a primary or advisory ice detection system. This AC accompanies changes to part 121 incorporated in the Activation of Ice Protection final rule (docket FAA-2009-0675).

Draft ACs Released for Public Comment

AC 25.803-1A, Emergency Evacuation Demonstrations. Comment period closed 4/18/2011.

This AC provides guidance on means, but not the only means, of compliance with Title 14, Code of Federal Regulations (14 CFR) part 25 concerning (1) conduct of full-scale emergency evacuation demonstrations, and (2) use of analysis and tests in lieu of conducting an actual demonstration. Throughout this AC, any reference to a full-scale demonstration, unless further qualified, means an evacuation demonstration in which a full complement of passengers and the requisite number of crewmembers evacuate an airplane using assist means, if installed, under the conditions specified in part 25, appendix J. Additionally, any reference to an analysis, which is to be used to satisfy the emergency evacuation requirements of part 25, means a formal analysis document supported by data from tests or demonstrations.

AD ARC Update

In August 2009, the FAA chartered the Airworthiness Directive Implementation Aviation Rulemaking Committee (AD ARC) to evaluate and address recommendations related to airworthiness directive processes. The AD ARC completed the tasks defined in its charter in August 2011 and transmitted its final report to the FAA. The final report outlines the AD ARC membership, activities, deliverables, and implementing actions. Additional background information and the AD ARC final report and deliverables can be found at http://www.faa.gov/aircraft/air_cert/continued_operation/ad/ad_arc/.

The links in the *Transport Certification Update* are current at the time of publication, but they are subject to change at any time. The target documents may be moved to another location, or the links may not remain active due to other factors beyond our control. We regret any inconvenience this may cause.

We welcome comments and questions. We might edit letters for style and/or length. If we have more than one letter on the same topic, we will select one representative letter to publish. Because of our publishing schedules, responses might not appear for several issues. We do not print anonymous letters, but we do withhold names or send personal replies upon request. Send letters to the address above or e-mails to: 9-ANM-TAD-Update@faa.gov

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